**Chapter 31. Faraday’s Law**

St. ID: , Name:

1. A circular loop of wire of radius 12.0 cm is placed in a magnetic field directed perpendicular to the plane of the loop as in Figure P30.1. If the field decreases at the rate of 0.050 0 T/s in some time interval, find the magnitude of the emf induced in the loop during this interval.

Ans: 2.26 mV

1. A long solenoid has *n* = 400 turns per meter and carries a current given by *I* = 30.0(1-*e-1.60t*), where *I* is in amperes and *t* is in seconds. Inside the solenoid and coaxial with it is a coil that has a radius of *R* = 6.00 cm and consists of a total of *N* = 250 turns of fine wire (Fig. P30.4). What emf is induced in the coil by the changing current?

Ans:

1. A conducting bar of length , moves to the right on two frictionless rails as shown in Figure P30.15. A uniform magnetic field directed into the page has a magnitude of 0.300 T. Assume *R* = 9.00 V and = 0.350 m. (a) At what constant speed should the bar move to produce an 8.50-mA current in the resistor? (b) What is the direction of the induced current? (c) At what rate is energy delivered to the resistor? (d) Explain the origin of the energy being delivered to the resistor.

Ans: (a) 0.729 m/s (b) counterclockwise (c) 0.650mW

(d) Work is being done by the external force, which is transformed into internal energy in the resistor.

1. A toroid having a rectangular cross section (*a* = 2.00 cm by *b* = 3.00 cm) and inner radius *R* = 4.00 cm consists of *N* = 500 turns of wire that carry a sinusoidal current *I* = *I*max sin *ωt*, with *I*max = 50.0 A and a frequency *f* = *ω*/2*π* = 60.0 Hz. A coil that consists of *N*’ = 20 turns of wire is wrapped around one section of the toroid as shown in Figure P30.9. Determine the emf induced in the coil as a function of time

Ans: